SECTION IV.—RIVERS AND FLOODS.

RIVERS AND FLOODS, FEBRUARY, 1916.

By ALFRED J. HENRY, Professor in Charge of River and Flood Division.

[Dated: Washington, D. C., Mar. 27, 1916.]

At the close of January, 1916, the Mississippi and the lower Ohio Rivers were at flood stages. The Mississippi at Cairo, Ill., passed below flood stage on February 17; at Memphis, Tenn., on February 23; at Helena, Ark., on March 1. At points below Helena the river was above flood stage the entire month of February. The Atchafalaya in Louisiana, the Yazoo in Mississippi ,and the Illinois at La Salle and Beardstown were also above the flood stage the entire month. At the close of the month the flood in the lower Mississippi was receding rapidly and there was every indication that no more agricultural land would be overflowed. The overflowed land during February and March, 1916, in the New Orleans river district amounted to about 285 square miles. The overflowed area in Mississippi and Arkansas has not yet been determined.

PROPERTY LOSS BY THE FLOODS OF JANUARY–FEBRUARY, 1916.

East of the Rocky Mountains.

Live stock and other movable farm property	$134,682.00
Suspension of business and loss of wages	186,962.00
Matured crops	88,600.00
Prospective crops	229,350.00
Tangible property, houses, bridges, etc	657,820.00
Loss to railroads, roadbeds, equipment, etc	1,014,772.00
Total	2,312,186.00

West of Rocky Mountains, southern California and Arizona.

Agricultural lands, washed away (Arizona)	$120,000.00
Irrigation works damaged and destroyed (Arizona)	101,000.00
Highways and bridges, excluding railway bridges	1,154,500.00
Agricultural lands, erosion or inundation	1,516,000.00
Irrigation works, including reservoirs, conduits, etc	2,000,000.00
Miscellaneous losses, excluding damage to railroads, telegraph and telephone companies	400,000.00
Total	5,291,500.00
Grand total	7,603,686.00
Estimated saving by warnings east of Rocky Mountains	1,208,140.00

About the usual number of flood stages occurred during the month in the various rivers, as shown by Tables 1 to 6, inclusive. The majority of these were of short duration and more or less local, except that the flood in the Willamette River of Oregon was quite general throughout the course of the stream. Tables 1 to 6 follow.

TABLE 1.—*Flood stages in the Red River and the rivers of Louisiana and Texas, February, 1916.*

River.	Station.	Flood stage.	Above flood stage. From—	Above flood stage. To—	Crest stage.	Date.
		Feet.			*Feet.*	
Red	Spring Bank, Ark	29.0	4	12	31.4	7
Do	Fulton, Ark	28.0	[1] 29	4	32.2	4
Do	Alexandria, La	36.0	13	20	36.8	16, 17
Do	Grand Ecore, La	30.0	5	19	35.7	12, 13
Sulphur	Finley, Tex	24.0	[1] 30	7	27.0	3
Little	Whitecliffs, Ark	28.0	3	3	28.4	3
Ouachita	Monroe, La	40.0	15	25	40.6	19, 20
Atchafalaya	Simmesport, La	41.0	3	(2)	48.5	[3] 1–6
Sabine	Logansport, La	25.0	1	6	26.4	3
Trinity	Long Lake, Tex	40.0	8	13	40.8	9
Do	Liberty, Tex	25.0	22	23	25.0	22, 23
Do	Trinidad, Tex	28.0	[1] 30	11	37.5	5

[1] January. [2] 41.3 feet on Mar. 29, 1916. [3] March.

TABLE 2.—*Flood stages in the rivers of the East Gulf and South Atlantic States, February, 1916.*

River.	Station.	Flood stage.	Above flood stage. From—	Above flood stage. To—	Crest stage.	Date.
		Feet.			*Feet.*	
Dan	Danville, Va	8.0	3	3	8.6	3
Do	Clarksville, Va	12.0	4	4	11.3	4
Roanoke	Weldon, N. C	30.0	3	6	39.7	5
Neuse	Neuse, N. C	12.0	3	7	18.4	5
Do	Smithfield, N. C	13.0	4	9	17.1	8
Cape Fear	Fayetteville, N. C	35.0	4	6	44.5	4
Do	Elizabethtown, N. C	20.0	4	8	30.2	6
Haw	Moncure, N. C	22.0	3	3	26.7	3
Saluda	Pelzer, S. C	7.0	2	3	8.6	2
Do	Chappels, S. C	14.0	3	5	20.3	4
Pee Dee	Cheraw, S. C	27.0	3	6	36.3	4
Do	Smiths Mills, S. C	14.0	10	17	16.8	12
Santee	Rimini, S. C	12.0	3	15	21.5	7
Do	Ferguson, S. C	12.0	5	18	15.7	9
Wateree	Camden, S. C	24.0	3	5	34.4	3
Catawba	Catawba, S. C	11.0	2	4	21.2	3
Congaree	Columbia, S. C	15.0	3	5	22.7	4
Broad (in South Carolina).	Blairs, S. C	14.0	3	4	20.9	3
Broad (in Georgia).	Carlton, Ga	11.0	2	2	12.4	2
Alabama	Selma, Ala	35.0	5	6	36.2	6

TABLE 3.—*Flood stages in the rivers of the Great Lakes drainage, in the Des Moines, and in the Connecticut, February, 1916.*

River.	Station.	Flood stage.	Above flood stage. From—	Above flood stage. To—	Crest stage.	Date.
		Feet.			*Feet.*	
Connecticut	Hartford, Conn	16.0	28	29	17.7	28
St. Joseph	Montpelier, Ohio	10.0	[1] 31	2	12.8	1
Sandusky	Tiffin, Ohio	10.0	1	2	10.3	1
Auglaize	Defiance, Ohio	10.0	1	2	11.5	2
Maumee	Napoleon, Ohio	10.0	1	2	11.7	2
Do	Fort Wayne, Ind	15.0	[1] 31	4	20.2	1
Grand	East Lansing, Mich	7.5	1	1	7.6	1
Do	Grand Rapids, Mich	11.0	5	11	15.3	7
Des Moines	Boone, Iowa	11.5	22	24	13.9	23

[1] January.

TABLE 4.—*Flood stages in the rivers of the Pacific slope, February, 1916.*

River.	Station.	Flood stage.	Above flood stage.		Crest stage.	Date.
			From—	To—		
		Feet.			*Feet.*	
Columbia	Vancouver, Wash.	15.0	12	13	15.7	12
Willamette	Eugene, Oreg.	10.0	7	9	18.2	7
Do.	Albany, Oreg.	20.0	8	10	28.0	8
Do.	Salem, Oreg.	20.0	8	10	26.2	9
Do.	Oregon City, Oreg.	12.0	8	14	15.0	10
Do.	Portland, Oreg.	15.0	9	14	20.0	11
Santiam	Jefferson, Oreg.	10.0	7	8	14.9	7
Yamhill	McMinnville, Oreg.	35.0	10	12	39.1	11
Clackamas	Cazadero, Oreg.	8.0	7	8	11.9	7
Sacramento	Red Bluff, Cal.	23.0	10	11	24.0	10
San Joaquin	Lathrop, Cal.	17.0	7	7	17.0	7

TABLE 5.—*Flood stages in the tributaries of the Ohio, February, 1916.*

River.	Station.	Flood stage.	Above flood stage.		Crest stage.	Date.
			From—	To—		
		Feet.			*Feet.*	
French Broad	Asheville.	4.0	3	3	4.0	3
Tennessee	Knoxville, Tenn.	12.0	3	4	14.0	3
Monongahela	Fairmont, W. Va.	25.0	13	13	25.0	13
Do.	Greensboro, Pa.	20.0	13	13	23.0	13
Do.	Lock No. 4, Pa.	31.0	14	14	31.7	14
Little Kanawha	Glenville, W. Va.	22.0	13	13	22.5	13
Do.	Creston, W. Va.	20.0	13	13	20.6	13
Walhonding	Walhonding, Ohio.	8.0	1	1	8.0	1
Scioto	Prospect, Ohio.	10.0	1	2	10.9	2
Do.	Circleville, Ohio.	7.0	1	3	11.1	1
Miami	Tadmor, Ohio.	12.0	[1] 31	1	14.8	1
Wabash	Bluffton, Ind.	12.0	1	2	13.5	1
Do.	Logansport, Ind.	12.0	[1] 31	2	14.6	1
Do.	La Fayette, Ind.	11.0	[1] 29	5	23.5	2
Do.	Terre Haute, Ind.	16.0	[1] 31	8	23.0	2
Do.	Mount Carmel, Ill.	15.0	[1] 1	17	26.7	7

[1] January.

TABLE 6.—*Flood stages in the Missouri River and tributaries, February, 1916.*

River.	Station.	Flood stage.	Above flood stage.		Crest stage.	Date.
			From—	To—		
		Feet.			*Feet.*	
Missouri	Blair, Nebr.	15.0	26	29	16.6	27
Blue	Beatrice, Nebr.	16.0	18	18	18.0	18
Grand	Chillicothe, Mo.	18.0	20	22	19.8	21
Osage	Bagnell, Mo.	28.0	[1] 28	4	32.8	1

[1] January.

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

SNOWFALL AT HIGH ALTITUDES, FEBRUARY, 1916.

An exceptionally heavy snow cover in the mountains accumulated during January, 1916. A severe snowstorm during the first few days of February, 1916, added a considerable amount in Oregon, Washington, Idaho, and in Montana, west of the Continental Divide. Subsequent weather, however, was not favorable to the conservation of the snow and by the close of the month much snow had disappeared from the lower levels up to 7,000 feet and on the south slopes. The remaining snow was well packed, and the outlook for irrigation and power water, though not so bright as at the close of the preceding month, was still favorable in practically all localities.—A. J. H.

RELATION OF PRECIPITATION TO STREAM FLOW IN MONTANA.

By R. FRANK YOUNG, Meteorologist.

[Dated: Weather Bureau, Dayton, Ohio, Feb. 14, 1916.]

The region under discussion in this paper is that portion of the northern Rocky Mountains which forms the headwaters basin of the Missouri-Mississippi drainage. It is outlined in figure 1, below.

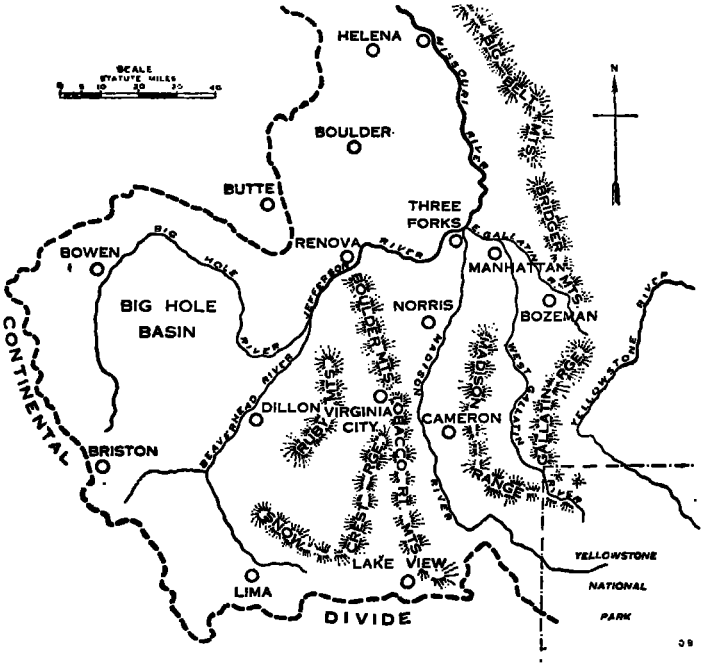

FIGURE 1.—Sketch map of the headwaters of the Missouri in Montana.

Investigations of the water resources in the Rocky Mountains have generally proceeded on the assumption that the most important, if not the only important influence controlling the summer flow of streams is the amount of snow accumulated in the mountains at the close of the snow season. The facts here presented seem to warrant the statement that the question is one of somewhat greater complexity than this view recognizes; but fortunately the greater complexity of the problem does not necessarily add to the difficulty of its solution. The great amount of labor involved in the measurement of the depth of snow over large areas, and the unavoidable inaccuracy of measurements of drifted snow, which may vary in depth from a few inches to 50 feet or more, would probably render this method impracticable for the northern Rocky Mountain region as a whole. Fuller investigation may show that more reliable estimates of the amount of moisture stored in the mountains can be made from careful and well distributed records of precipitation and temperature, supplemented by evaporation measurements, than from any number of measurements of snow on the ground. This applies particularly to the eastern slope of the northern Rockies where the snow, as a rule, is nearly all blown into drifts, and where under normal temperature conditions there is practically no loss except by evaporation during the winter months.